

# Anatomical evidence of flash flood events in different Mediterranean tree species

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The contribution aims to identify anatomical responses of different Mediterranean tree species to flash floods in order to define reliable indicators of past events in the tree-ring record. With this purpose, wood anatomical analyses were performed for different Mediterranean trees that were scarred by transported debris during an extraordinary flash flood that took place in the stream Arroyo Cabrera (Spanish Central System) in December 1997. In the field, wood samples were collected from scarred trees located along the riverbank with a hand saw and increment borers. In the laboratory, samples were sanded, scanned and ring widths measured with a LINTAB measurement device and TSAP software. Thereafter, 70 micro-sections were prepared using a sliding microtome, stained and dried. Digital images were then taken at 50x magnification with a digital camera attached to a microscope. In a final step, quantitative as well as qualitative anatomical parameters were assessed using Régent WinCell software. Results show a significant variability in the wood anatomical reactions of the different tree species to the 1997 flash-flood event. For all species, we identify changes in earlywood cell lumen and earlywood tracheid dimension. In addition, (i) cell wall percentage increases in pine, (ii) the size of vessels decreases in alder, ash and oak and (iii) the dimension of the earlywood cells around vessels increases in alder and poplar. Finally, we also observed the formation of false rings following flash floods in alder, disturbance-related gum deposits in alder, ash and oak as well as the presence of chaotic callus tissue in all species. These dendrogeomorphological indicators represent a very useful tool for the detection of past events in ungauged catchments, the improvement of our understanding of this geomorphic phenomenon as well as for a non-destructive sampling of trees in future studies. Keywords: Dendrogeomorphology, flash flood, tree rings, Mediterranean trees